PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-072310
(43)Date of publi ati n of application : 17.03.1995

)Int.Cl. G02B 3/02
G02B 1/04

)Application number : 05-221005
!)Date of filing : 06.09.1993

(71)Applicant : NIKON CORP
(72)Inventor : KONDO AKIRA
TOKUCHI SHIGEO

4) PRODUCTION OF ASPHERICAL OPTICAL ELEMENT

7)Abstract:
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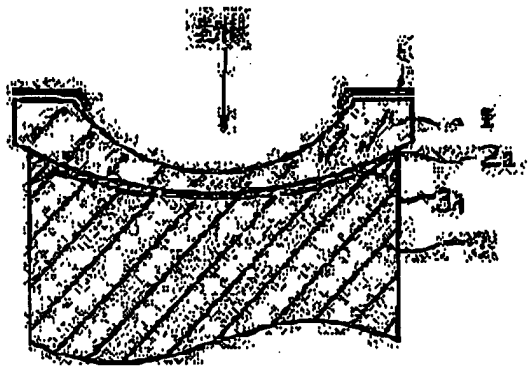

GAL STATUS
)ate of request for examination] 01.06.2000
)ate of sending the examiner's decision of j ction]
Kind of final disposal of application other than ıe examiner's decision of rejection or)plication converted registration]
)ate of final disposal for application]
)atent number]
)ate of registration]
Number of appeal against examiner's decision f rejection]
)ate of requesting appeal against examiner' ecision of rejecti n]

(19)日本国特許庁（JP）　(12)公開特許公報（A）　(11)特許出願公開番号
特開平7－72310
(43)公開日　平成7年(1995)3月17日

(51)Int.Cl.[6]		識別記号	庁内整理番号	FI	技術表示箇所
G02B	3/02		8106－2K		
	1/04		7724－2K		

審査請求　未請求　請求項の数2　OL　（全6頁）

(21)出願番号　特願平5－221005

(22)出願日　平成5年(1993)9月6日

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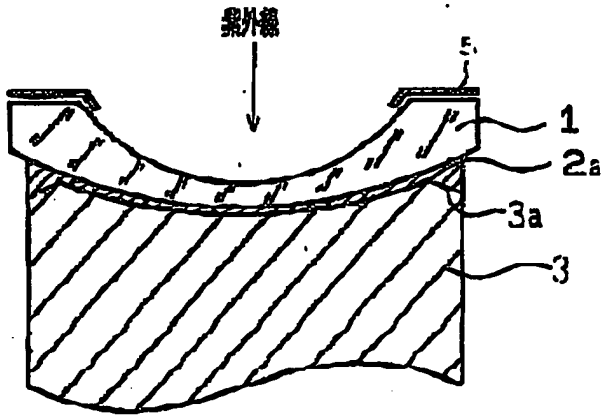
(72)発明者　笹地　滋生
東京都千代田区丸の内3丁目2番3号　株式会社ニコン内

(54)【発明の名称】　非球面光学素子の製造方法

(57)【要約】
【目的】　精度を低下させずに非球面光学素子を製造し、品率を向上させる。
【構成】　所望の非球面とは反転した非球面を有する金型3と素子基材1との間に樹脂液2aを挟み、該樹脂液を所望の領域の外側まで広げてから硬化させて非球面樹脂成形層2を形成し、該非球面樹脂成形層を金型との界面から剥離させることで、「有効径付近の樹脂厚が外周部に向かうにつれて薄くなるように形成された非球面樹脂成形層と素子基材からなる非球面光学素子」を得る非球面光学素子の製造方法において、金型または素子基材の少なくとも一方に対し、光学素子の有効径より外側となる外周部に切り欠け3aを設けた。



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 02-234103
(43)Date of publication of application : 17.09.1990

(51)Int.Cl. G02B 3/02

(21)Application number : 01-054472
(22)Date of filing : 07.03.1989

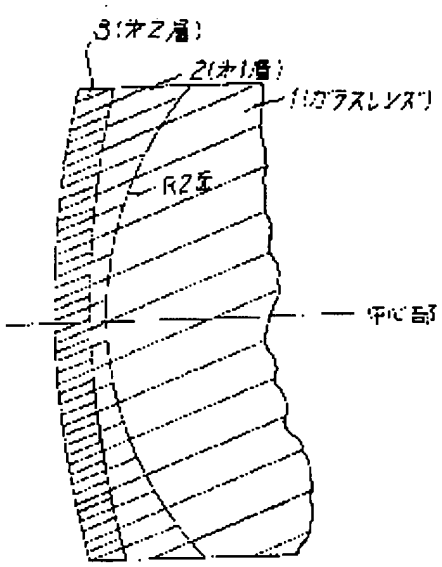
(71)Applicant : NIKON CORP
(72)Inventor : KONDO AKIRA
KINOSHITA YUTAKA
TOKUCHI SHIGEO

(54) RESIN CEMENTED TYPE ASPHERICAL LENS

(57)Abstract:

PURPOSE: To form a thin resin molding layer in a desired aspherical surface shape directly on the surface of a glass lens which forms a principal part by setting the thickness of the center part of a 1st resin molding layer less than that of a 2nd resin molding layer.

CONSTITUTION: The 1st layer 1 and 2nd layer 3 are formed on the R2 surface (close to a desired aspherical surface) of the glass lens 1, which is ground to, for example, a 2mm center thickness so that the concave surface has 20mm curvature and the R2 surface (convex surface) has 70mm curvature. Then the 1st layer 2 formed on the R2 surface side of the glass lens 1 is 10μm thick at the center part and 200μm thick at the peripheral part. The 2nd layer 3 formed on the 1st layer 2 has nearly uniform thickness on the whole and is 30μm thick at both the center and peripheral part. Namely, the 2nd layer 3 is 1/3 time as thick as the 1st layer 2 at the center part. Consequently, the shape error of the surfaces can be made small and the overall thickness can be reduced, so the shape error of the surfaces is prevented from increasing.



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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-072310

(43)Date of publication of application : 17.03.1995

(51)Int.Cl. G02B 3/02
G02B 1/04

(21)Application number : 05-221005

(22)Date of filing : 06.09.1993

(71)Applicant : NIKON CORP

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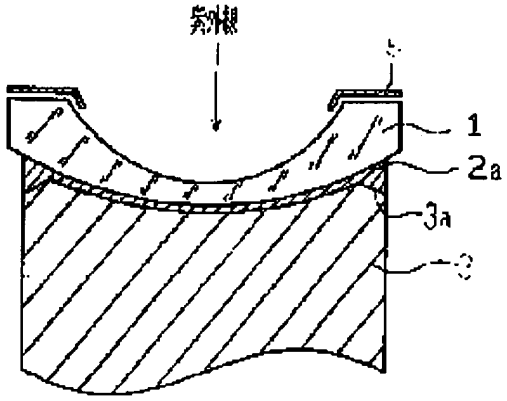
(54) PRODUCTION OF ASPHERICAL OPTICAL ELEMENT

(57)Abstract:

PURPOSE: To produce the aspherical optical element without lowering its accuracy and to improve a nondefective rate.

CONSTITUTION: At least either of a metal mold 3 having an aspherical surface inverted from a desired aspherical surface or an element base material 1 is provided with a notch 3a in the outer peripheral part which is on the side outer than the effective diameter of the aspherical optical element in the process for production of the aspherical optical element for obtaining 'the aspherical optical element consisting of an aspherical resin molding layer 2 formed in such a manner that the resin thickness near the effective diameter decreases toward the outer peripheral part and the element base material 1' by holding a resinn liquid 2a between the metal mold 3 and the element base material 1 and spreading the resin liquid to the outer side of the desired region, then curing the resin liquid.



LEGAL STATUS

[Date of request for examination] 01.06.2000

[Date of sending the examiner's decision of

rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3409383

[Date of registration] 20.03.2003

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the method of manufacturing the aspheric surface optical element which consists of an aspheric surface resin fabrication layer and an element base material. An "aspheric surface optical element" points out an aspheric lens and "the blank of a reflecting mirror with the reflector of the aspheric surface" here. It will become a reflecting mirror if this reflecting layer that consists of aluminum, silver, or a multilayer optical thin film blank is formed. An example of the element manufactured by this invention is conventionally called resin assembling-die lens.
[0002]
[Description of the Prior Art] As for the lens used for optical products, such as a camera and a microscope, the glass lens is mainly used. The glass lens is manufacturing the lens which has desired curvature by machining to the glass block (called a lens blank) by which press forming was carried out from the glass of a melting state. The method of replacing with glass and manufacturing a resin lens by methods, such as press forming, injection molding, and casting, using a resin is also put in practical use. Once this method manufactures mold, since it can mass-produce a lot of lenses using it, it has the feature that a manufacturing cost is cheap. However, a resin lens has the fatal fault of changing optical-character ability sharply by change of temperature or humidity, and is not used for the precise lens.
[0003] By the way, there is an aspheric lens in a lens and the shape of surface type is the aspheric surface. Generally this aspheric surface is the symmetry of revolution focusing on an optical axis. The aspheric lens is appointed to a position of a trust from having the outstanding performance which is not obtained by the spherical lens. However, if an aspheric lens is manufactured at the same process (grinding -> polish) as a spherical lens, it will take time and effort and time very much. Therefore, there is a fault that a manufacturing cost becomes high fairly rather than a spherical lens.
[0004] In order to solve this fault, the resin assembling-die aspheric lens as shown in drawing 7 and drawing 8 was developed. This consists of a glass lens (element base material) 1 used as the thin (for example, 5 - 100 mum) resin fabrication layer 2 with which it has the aspheric surface, and a subject. The element base material 1 has the spherical surface (drawing 7 : refer to JP,60-56544,A) or the coarse aspheric surface (drawing 8 : refer to JP,63-157103,A). Each of both can receive with a cheap manufacturing cost. Such a resin assembling-die aspheric lens is manufactured by the process which consists of a process of for example, following (a) - (b). Please refer to drawing 9 .
(a) With the desired aspheric surface, the reversed aspheric surface The interval of the process (d) glass lens 1 and metal mold 3 which carry the glass lens 1 which has (Process b) process (c) spherical surface which hangs down radiation-curing type resin liquid 2a of the specified quantity to the center section of metal mold 3 or the coarse aspheric surface which places horizontally the metal mold 3 which it has on metal mold 3 is made to approach to a predetermined value (at this time). a resin -- liquid -- the purpose -- ** -- carrying out -- a lens -- an effective diameter -- outside -- spreading -- **** -- a process -- (-- e --) -- a glass lens -- one -- metal mold -- three -- between -- inserting -- having had -- a resin -- liquid -- two -- a -- radiation -- four -- irradiating -- things -- hardening -- making -- a process -- (-- f --) --

hardening -- carrying out -- obtaining -- having had -- a resin -- fabrication -- a layer -- two -- metal mold --
[Problem(s) to be Solved by the Invention] In the above aspheric surface optical elements, in near the effective diameter of this optical element, it may become thin with the case (refer to drawing 3) where it becomes thick as resin fabrication layer thickness goes to the periphery section. By the way, in the conventional process, when irradiating resin liquid and making it harden radiation, the resin layer exfoliated from metal mold or the base material (glass lens) in the middle of hardening, and the bubble (foam) was involved in the periphery section of a resin fabrication layer. Therefore, there were many examples to which the configuration precision of the front face (aspheric surface) of the resin fabrication layer 2 becomes low. In the case of a configuration which becomes thin, it was easy to produce such a phenomenon as were especially shown in drawing 4 and the resin fabrication layer went to the periphery section of an effective diameter. Since the configuration precision of a resin fabrication layer front face served as a defective, as for the conventional process, the low product had a problem of a low in the rate of an excellent article. The purpose of this invention is by decreasing the example to which configuration precision becomes low to raise the rate of an excellent article.
[0006]
[Means for Solving the Problem] For the above-mentioned purpose, resin liquid is inserted with the desired aspheric surface by this invention between the metal mold and the element base materials which have the reversed aspheric surface. it hardens, after extending to the outside of the field of a request of this resin liquid -- making -- an aspheric surface resin fabrication layer -- forming -- this aspheric surface resin fabrication layer -- the above -- by making it exfoliate from an interface with metal mold In the manufacture method of the aspheric surface optical element which obtains "the aspheric surface optical element which consists of an aspheric surface resin fabrication layer formed so that it might become thin as the resin thickness near an effective diameter goes to the periphery section, and an element base material" the above -- it cut to either [at least] metal mold or the element base material in the periphery section used as an outside [effective diameter / of the aforementioned optical element], and the chip was prepared
[0007]
[Function] If it cuts in the periphery section of metal mold or an element base material and a chip is prepared as a result of wholeheartedly research of this invention persons, since it will be compensated with the resin liquid which the amount of [of this liquid generated while hardening of resin liquid advances] hardening contraction cut, and was stored in the chip portion, it turns out that a resin fabrication layer (liquid) exfoliates neither from metal mold nor an element base material in the middle of hardening, or a bubble (foam) is not involved in the periphery section of a resin fabrication layer. It is made not to affect the performance of the obtained optical element by this invention by setting the position in which an end chip is prepared as the periphery section of the metal mold used as an outside [effective diameter / of a desired aspheric surface optical element], or an element base material. In addition, it is more desirable to have performed the processing as each element base material of an aspheric surface optical element that it is the same when it prepares in an element base material although what is necessary is just to prepare an end chip at least in one side of metal mold and an element base material, and for trouble to prepare in metal mold for this reason.
[0008] In case resin liquid is stiffened, it is good to irradiate radiation first through the shading member which shades the aforementioned end chip portion at the aforementioned resin liquid, and to irradiate radiation after that at the aforementioned resin liquid including the portion currently shaded by the aforementioned shading member. In this case, in the case of the irradiation to begin, since resin liquid collected on the end chip section is in the state where it does not harden, the supplement effect for hardening contraction of resin liquid becomes [a resin] being easy to move more notably.
[0009] Although it is desirable that it is glass as for the element base material which serves as a subject in this invention, it is good also as a product made of a resin by the case. A convex lens configuration, a concave lens configuration, a plate, and a rectangular parallelepiped are [that what is necessary is just to set up according to the optical element made into the purpose] sufficient as a configuration. Generally, a

base material is a glass spherical lens. However, the glass lens which has the coarse aspheric surface is sufficient as a plane of composition. It has a process tolerance ruder than a desired process tolerance or desired profile irregularity (for example, 6 micrometers the following or 3 micrometers henceforth), and the same as that of the desired aspheric surface or the thing which has the approximate aspheric surface is called coarse aspheric surface. Since such a glass lens may be coarser than a desired process tolerance, although it is an aspheric lens, a manufacturing cost does not become high so much. Already, such a manufacture method of an aspheric lens is well-known, and can be easily manufactured with a commercial grinding machine.

[0010] In order to raise adhesive strength with a resin (layer), as for a glass element base material, it is desirable to carry out silane coupling processing beforehand. resin fabrication layer thickness -- general -- a center -- one to 500 micrometer desirable -- five to 100 micrometer it is . Except when fabricated by the aspheric surface of a process tolerance with the coarse target element, the refractive index of a resin fabrication layer and an element base material does not necessarily need to be in agreement.

[0011] This resin fabrication layer is formed by stiffening resin liquid. As a resin (liquid) used, thermoplastics, a radiation-curing type resin (thermosetting resin), a monomer, etc. are mentioned. As thermoplastics, a polymethylmethacrylate (acrylic resin), thermoplastic BORIE stere, a polyvinyl chloride, polystyrene, a polycarbonate, etc. can be used. In this case, after heating, putting the fused resin liquid between an element base material and metal mold and extending to the outside of a desired field, a resin fabrication layer is obtained by making it cool and harden.

[0012] As a radiation-curing type resin, thermosetting resin, such as an epoxy resin, a unsaturated polyester, polyurethane, an ultraviolet-rays hardening type resin, and conversion acrylic resin, is mentioned. After putting these between an element base material and metal mold while they have been liquefied, and extending them to the outside of a desired field, they obtain a resin fabrication layer by irradiating radiation and stiffening it. As radiation, ultraviolet rays, an electron ray, a gamma ray, alpha rays, etc. are used, for example. Moreover, when hardening only by heating, you may make it harden by carrying out putting into warm water metal mold and the whole element base material etc.

[0013] As a monomer, ethylene system unsaturation monomers, such as acrylate, such as methyl methacrylate, ethylene methacrylate, methyl acrylate, ethyl acrylate, and butyl acrylate, and an acrylic acid, styrene, a butadiene, and a divinylbenzene, etc. are mentioned. Although a drawing is quoted and the example of this invention is explained hereafter, this invention is not limited to this.

[0014]

[Example] Drawing 2 is the vertical cross section of the aspheric lens (aspheric surface optical element) manufactured by this example.

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CLAIMS

[Claim(s)]
[Claim 1] Resin liquid is inserted between the metal mold and the element base materials which have the reversed aspheric surface with the desired aspheric surface. it hardens, after extending to the outside of the field of a request of this resin liquid -- making -- an aspheric surface resin fabrication layer -- forming -- this aspheric surface resin fabrication layer -- the above -- by making it exfoliate from an interface with metal mold In the manufacture method of the aspheric surface optical element which obtains "the aspheric surface optical element which consists of an aspheric surface resin fabrication layer formed so that it might become thin as the resin thickness near an effective diameter goes to the periphery section, and an element base material" the above -- the manufacture method of the aspheric surface optical element characterized by having cut to either [at least] metal mold or the element base material in the periphery section used as an outside [effective diameter / of the aforementioned optical element], and preparing a chip
[Claim 2] The manufacture method of the aspheric surface optical element first characterized by to irradiate radiation at the aforementioned resin liquid through a shading means to shade "the outside of the field of the aforementioned request in this resin liquid", and to irradiate radiation after that at the aforementioned resin liquid including the portion currently shaded by the aforementioned shading means in the manufacture method of an aspheric surface optical element according to claim 1 in case the aforementioned resin liquid is stiffened.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the schematic diagram showing vertical sections, such as a lens in each process of ** and the manufacture method concerning the example of this invention.
[Drawing 2] They are ** and the outline vertical cross section of the aspheric lens (resin assembling die) manufactured in the example of this invention.
[Drawing 3] It is the schematic diagram showing the thickness of the resin liquid (resin fabrication layer) to radial [of the base-material lens in the aspheric lens which becomes thick] as ** and resin liquid (resin fabrication layer) go to the periphery section of an effective diameter.
[Drawing 4] It is the schematic diagram showing the thickness of the resin liquid (resin fabrication layer) to radial [of the base-material lens in the aspheric lens which becomes thin] as ** and resin liquid (resin fabrication layer) go to the periphery section of an effective diameter.
[Drawing 5] It is the schematic diagram showing the irradiation range of the ultraviolet rays at the time of installing ** and a mask 5.
[Drawing 6] It is the schematic diagram showing the thickness of ** and the resin liquid to radial [of a glass lens].
[Drawing 7] It is the outline vertical cross section of ** and the conventional resin assembling-die aspheric lens.
[Drawing 8] It is the outline vertical cross section of ** and the conventional resin assembling-die aspheric lens.
[Drawing 9] It is the schematic diagram showing vertical sections, such as a lens in each process of ** and the conventional manufacture method.
[Drawing 10] They are ** and the outline vertical cross section of an aspheric lens (resin assembling die).
[Description of Notations in the Main Part]
1 Glass Lens, Element Base Material, or Base-Material Lens
2 Aspheric Surface Resin Fabrication Layer
2a Resin liquid (ultraviolet-rays hardening type resin liquid)
3 Metal Mold
3a End chip
4 Radiation (Ultraviolet Rays)
5 Mask (Shading Means)

[Translation done.]

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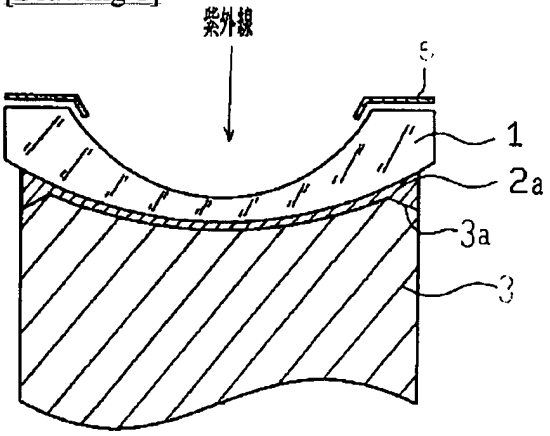
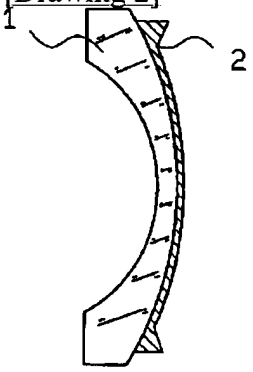
DRAWINGS

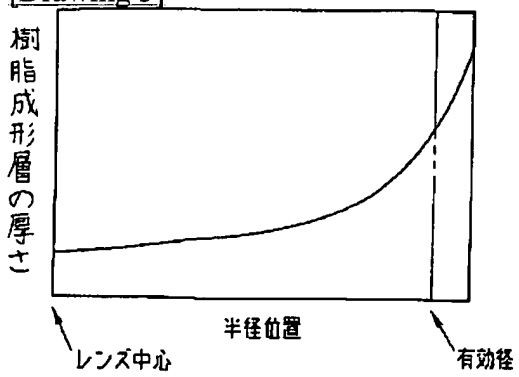
[Drawing 1]



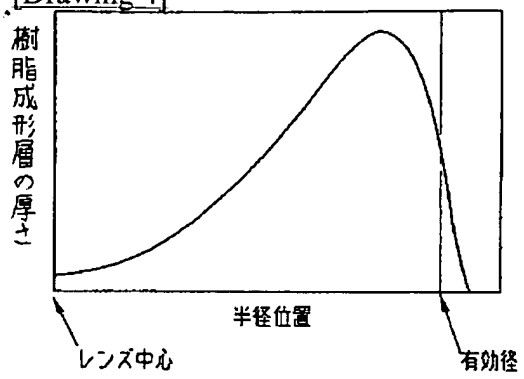
[Drawing 2]



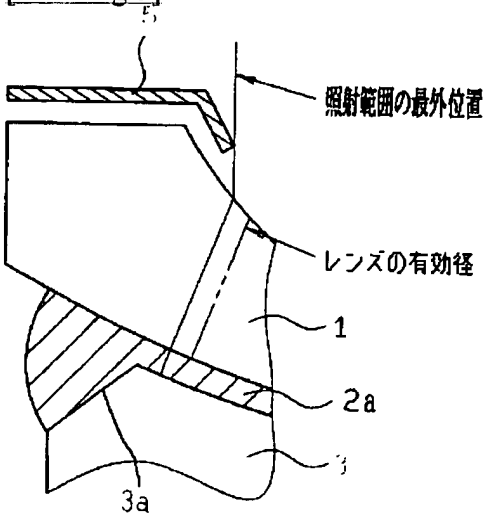
[Drawing 3]



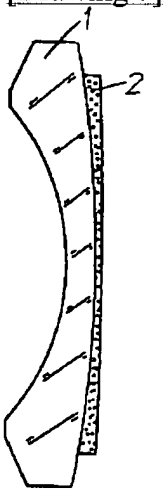
[Drawing 4]



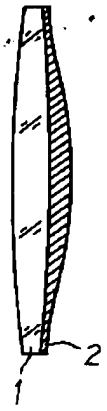
[Drawing 5]



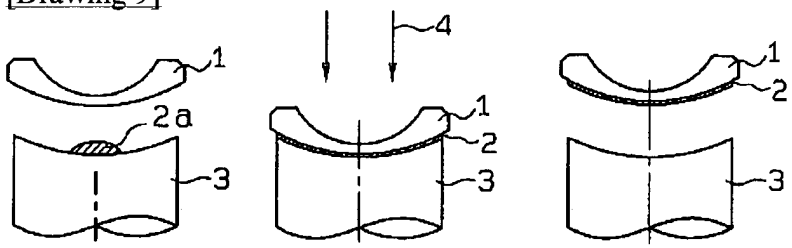
[Drawing 7]



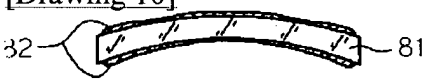
[Drawing 8]



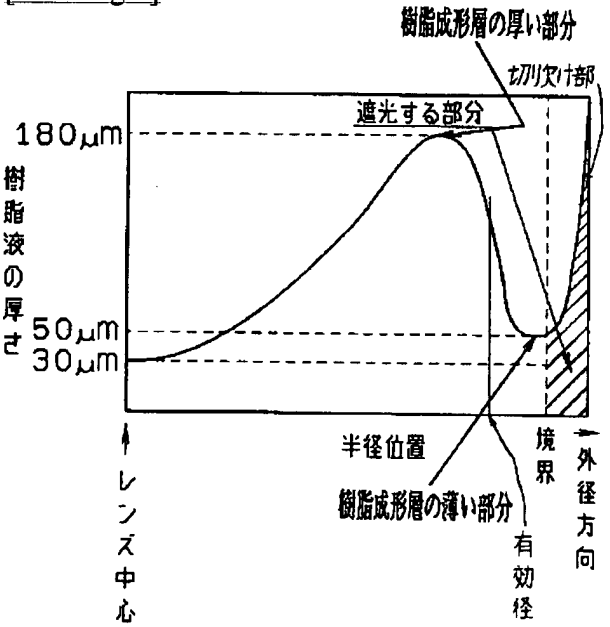
[Drawing 9]



[Drawing 10]



[Drawing 6]



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